VLB ARRAY MEMO No. 482

NATIONAL RADIO ASTRONOMY OBSERVATORY
Socorro, New Mexico

1 Sept. 1985

To: Configuration Group
From: Craig Walker
Subject: Alternative to OVRO.

There has been considerable pressure lately to place the "OVRO" antenna of the VLBA far enough from the existing telescope at the Owens Valley Radio Observatory to allow a useful, short baseline between them. The VLBI Consortium almost made a recommendation to this effect except that, as the discussion slowed down with a recommendation nearly finalized, the topic was switched. Recent RFI results, along with the previously known limited horizons, add some support to the concept of finding an alternative.

I have identified a possible alternative to OVRO and present the uv coverage obtained with it in this memo. I have not made an exhaustive investigation but have checked sites both north and south of OVRO but still in the Owens Valley, in Nevada to the NE and SE of OVRO and in the central valley to the SW of OVRO. During the original configuration studies, sites near Goldstone and at several other locations in Southern California were checked. My favored site is to the southwest of Fresno in California's central valley. This is flat country used primarily for farming so the RFI checks will be important. We might be able to get to the foothills further west if necessary.

Figure 1 shows the coverage of the VLBA with the Fresno site (called FRESNOSW) plus OVRO and four VLA antennas on the 500 km scale. The shortest, single baseline (as opposed to a cluster of baselines from the VLA to close VLBA sites) is the OVRO to FRESNOSW baseline. Baselines from FRESNOSW to other VLBA antennas will be rather close to the equivalent baselines to OVRO. The short baseline is in the range of spacings that is poorly covered by the VLBA. A site west of Las Vegas, Nevada provided somewhat better coverage with the short baseline but, unfortunately, opened up a big hole at high declinations at over 1000 km when the VLBA is used without OVRO.

Figures 2, 3, and 4 show the coverage of just the VLBA using the Fresno site on scales of 1000, 2000, and 4000 km. The coverage is good as can be seen by comparing with earlier memos showing just the VLBA (also in the project book). It is important to check these scales as was driven home by the Nevada site mentioned above. I had nearly selected it as my favorite and was doing a 'routine' check of larger scales when I found the fatal flaw. Note that the rather visible hole at over 2000 km at 64 deg. dec. in the coverage using

OVRO is much smaller using FRESNOSW. That hole was relatively small in a percentage sense so I was not very concerned about it, but it is nice to have it reduced. The coverage with OVRO and with FRESNOSW are sufficiently similar that it would be difficult to choose between them on coverage grounds alone.

Figure 5 shows how some of the VLA/VLBA hole at short baselines could be filled using the VLBA with FRESNOSW and Quabbin (FCRAO) with the pre-existing antennas at Green Bank (NRAO), Maryland Point (NRL), OVRO, Haystack (HSTK), and Goldstone (DSS13). The coverage is still sparse just outside the dense region of the VLA-Pie Town and Quabbin-Haystack baselines but some science could certainly be done. To help interpret the plots, the Fresno-OVRO baseline can be identified by refering to Figure 1, the due east-west baseline is Green Bank-Maryland Point, and the somewhat longer but isolated (not VLA) baselines to the upper right or lower left are those from Goldstone to Fresno and OVRO.

Figure 6 shows how the Fresno-OVRO baseline would add to the VLBA plus VLA if three antennas are built in New Mexico to fill the VLA/VLBA gap. The Fresno-OVRO baseline fits nicely in a rather large gap at the equitorial declinations (this is the gap that drove me toward an alternate four antenna scheme). Also note that the coverage with the three additional antennas is much better than with the existing antennas of Figure 5.

What should we do? I'm still sitting on the fence. The local support and ease of construction and land aquisition will be very good at OVRO (at least as long as the observatory lasts which will probably be a long time - how's your crystal ball?). The Fresno site will be remote from astronomy institutions but not as remote as OVRO from air transportation. It may also have RFI problems. It is on the wet side of the Sierra Nevada. While certainly not rain forest, it will have more atmospheric moisture than OVRO. However it does provide additional scientific capabilities. This will be discussed at the project review in Green Bank next week.

HAWAII	19.80	155.50
ARECIBO	18.34	66.75
HSTK	42.43	71.49
OROVILE	48.90	119.75
OVRO	37.05	118.28
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
IOWA	41.58	91.57
AN9	34.24	107.63
AW9	33.97	107.81
AE9	34.00	107.41
AW3	34.06	107.64
FRESNOSW	36.50	120.50

Scale in km
(: kilometers x 10^2)

500 km

Includes FRESNOSW and OVRO

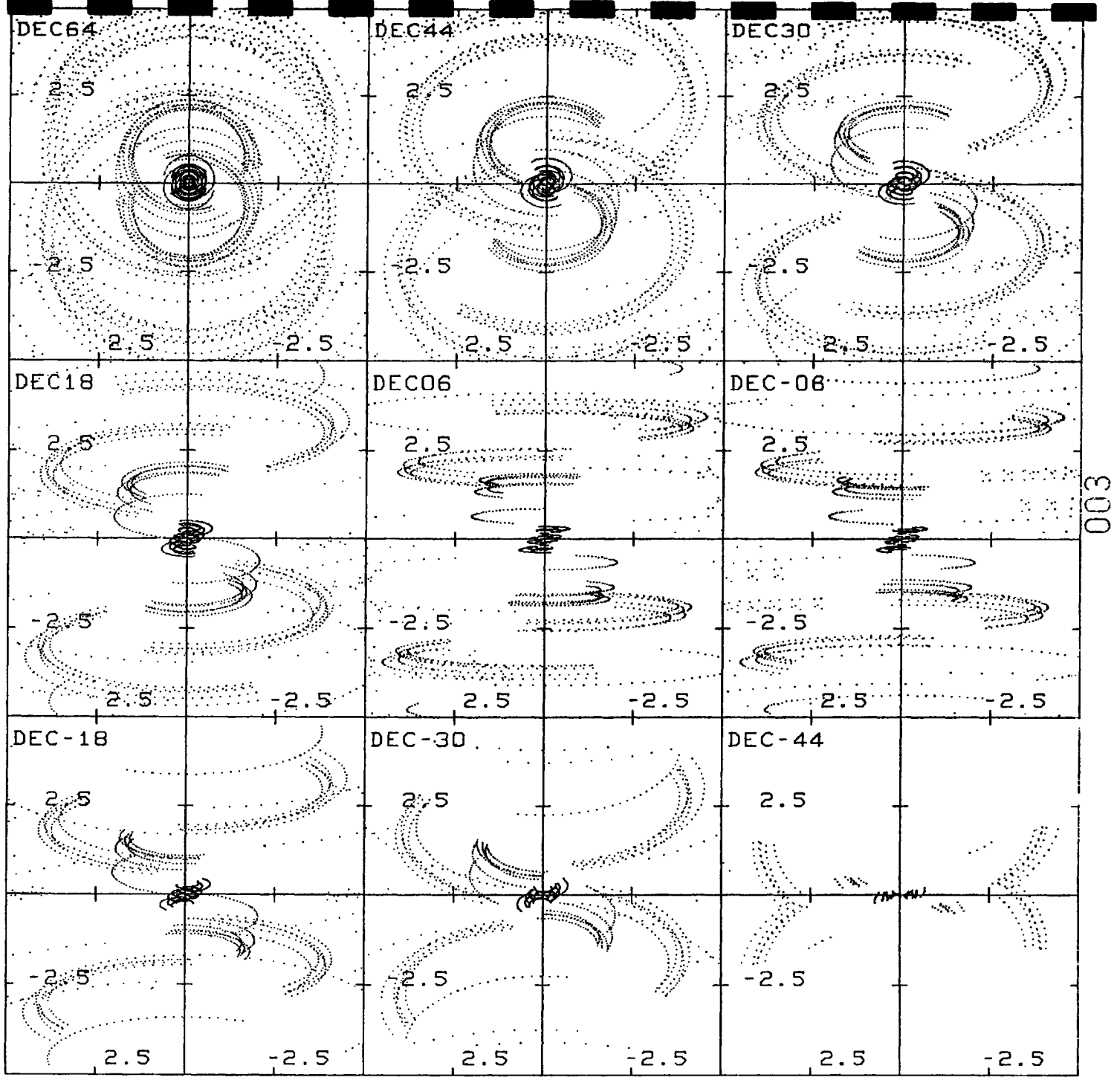

Figure 1

HAWAII	19.80	155.50
ARECIBO	18.34	66.75
HSTK	42.43	71.49
OROVILE	48.90	119.75
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
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KITT	31.96	111.60
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AW9	33.97	107.81
AE9	34.00	107.41
AW3	34.06	107.64
FRESNOSW	36.50	120.50

Scale in km
(: kilometers x 10^2)

No ouro

1000 km

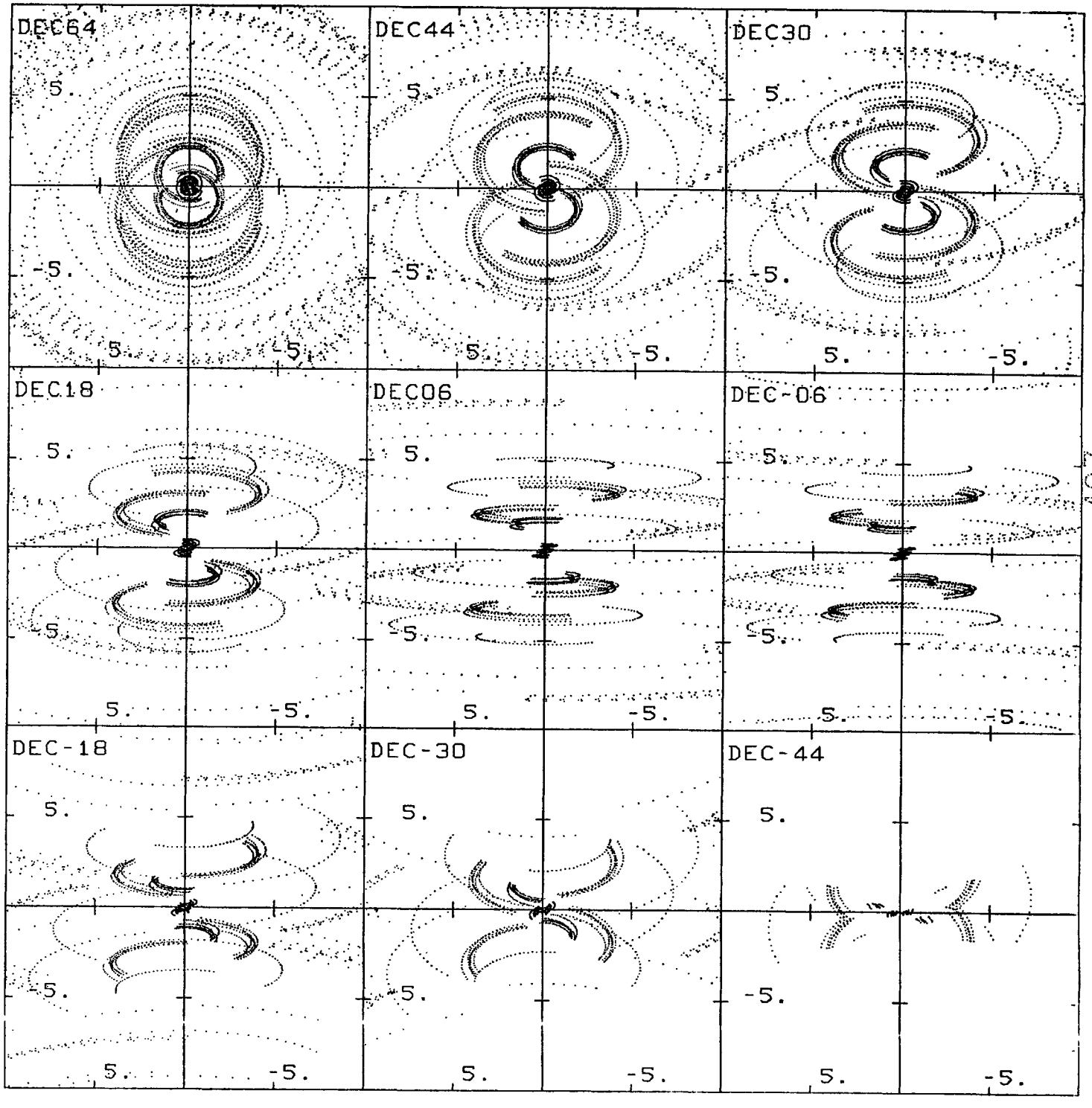


Figure 2

PIETOWN	34.33	108.14
KITT	31.96	111.60
LASL2	35.81	106.27
OROVILE	48.90	119.75
FDVSNEW	30.47	103.95
ARECIBO	18.34	66.75
IOWA	41.58	91.57
HAWAII	19.80	155.50
HSTK	42.43	71.49
FRESNOSW	36.50	120.50

Scale in km
: kilometers x 10^2)

2000 km

NO OVRO

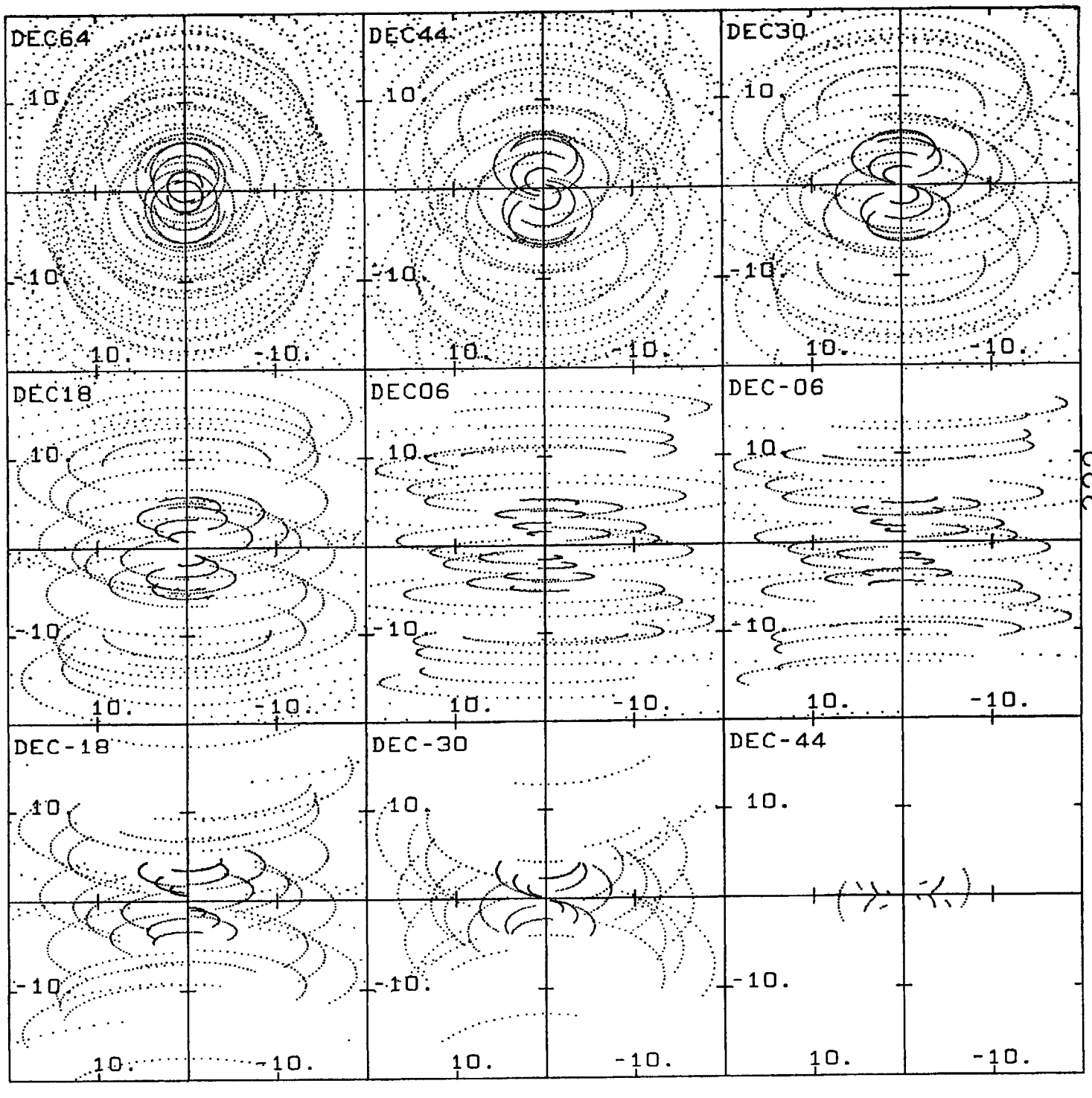


Figure 3

PIETOWN	34.33	108.14
KITT	31.96	111.60
LASL2	35.81	106.27
OROVILE	48.90	119.75
FDVSNEW	30.47	103.95
ARECIBO	18.34	66.75
IOWA	41.58	91.57
HAWAII	19.80	155.50
HSTK	42.43	71.49
FRESNOSW	36.50	120.50

Scale in km
: kilometers x 10^3)

4000 km

No ovro

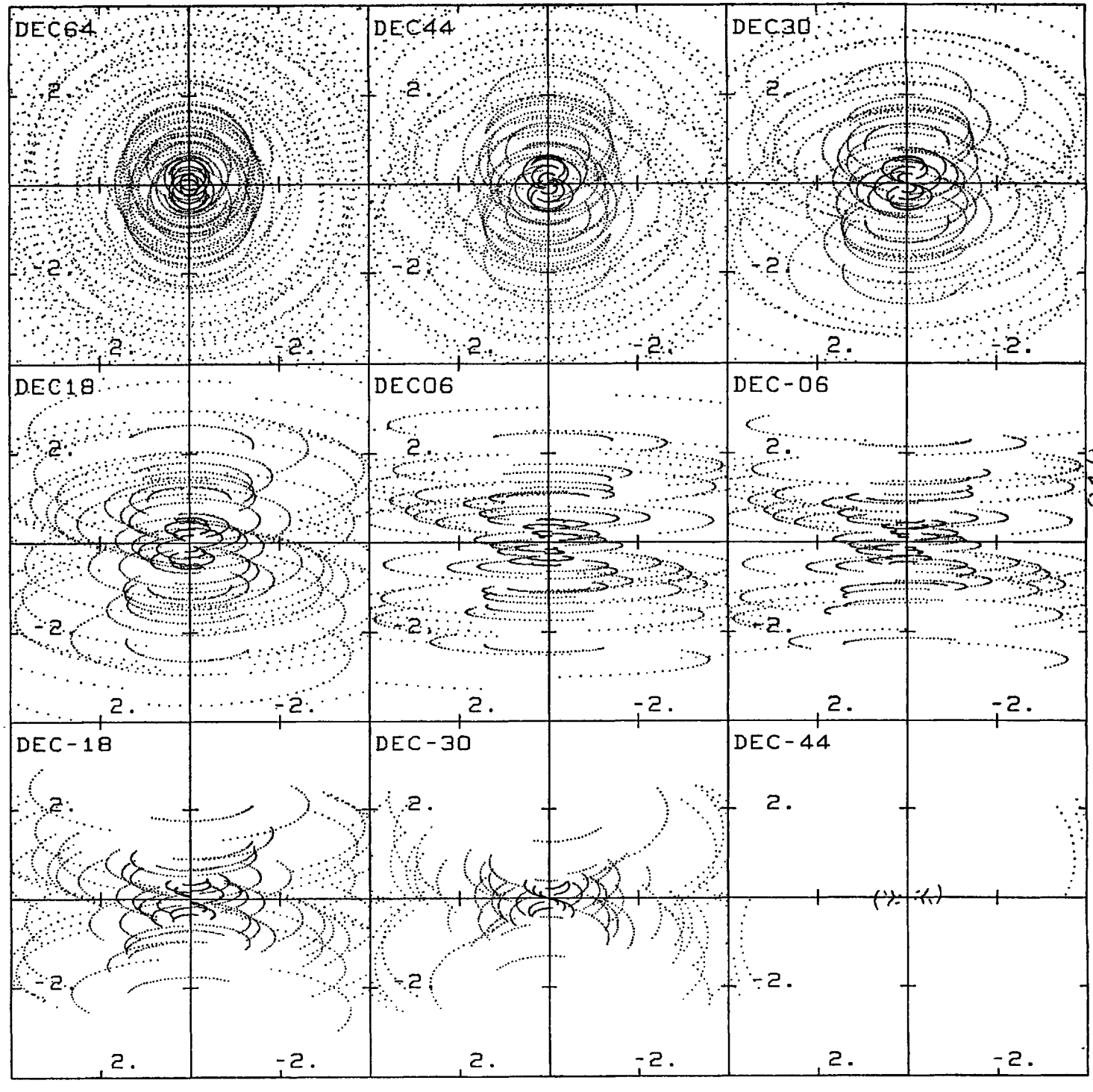


Figure 4

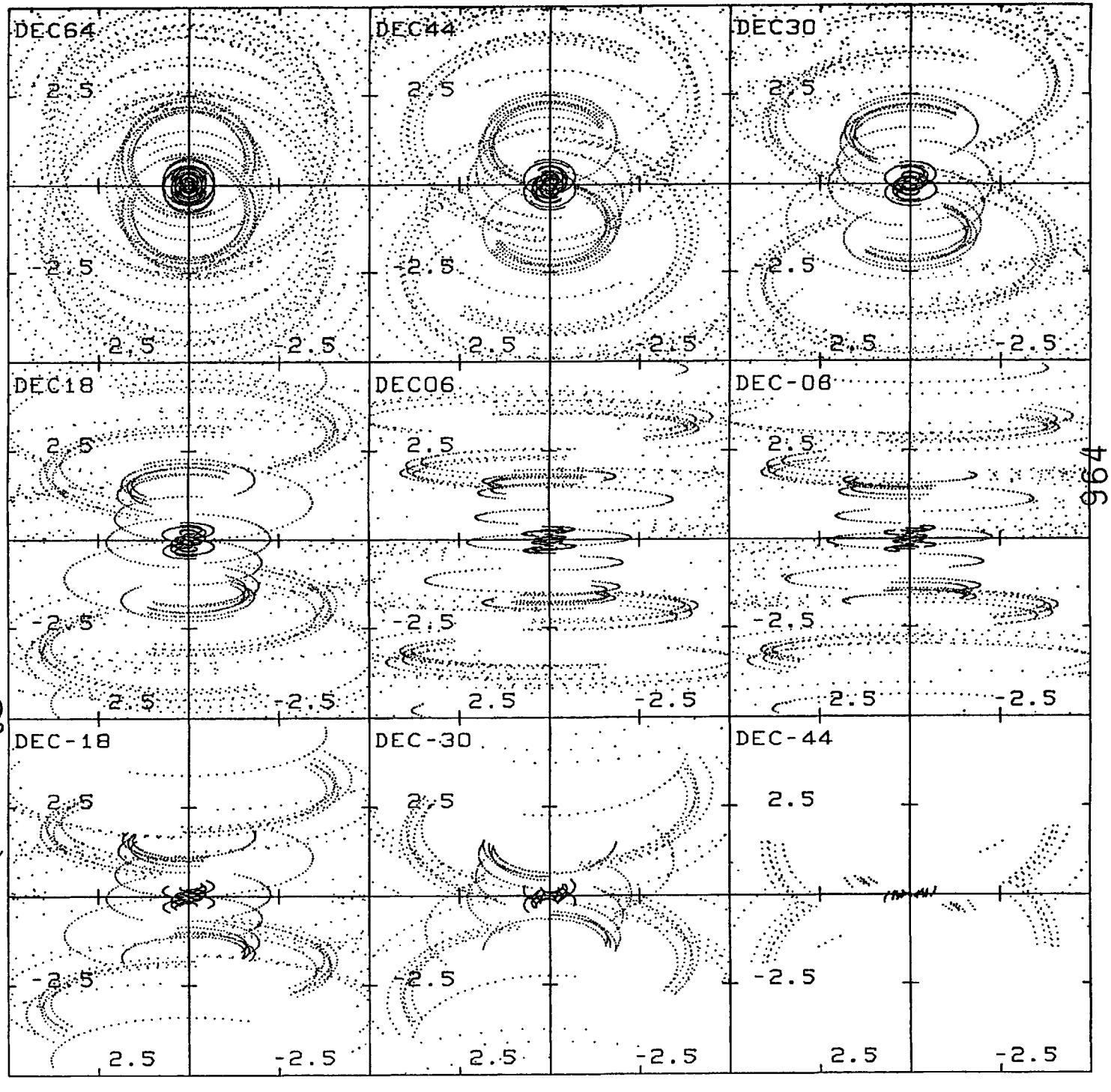
PIETOWN	34.33	108.14
KITT	31.96	111.60
LASL2	35.81	106.27
OROVILE	48.90	119.75
FDVSNEW	30.47	103.95
ARECIBO	18.34	66.75
IOWA	41.58	91.57
OVRO	37.05	118.28
HAWAII	19.80	155.50
HSTK	42.43	71.49
AN9	34.24	107.63
AW9	33.97	107.81
AE9	34.00	107.41
AW3	34.06	107.64
FRESNOSW	36.50	120.50
DSS13	35.07	116.79
FCRAO	42.40	72.33
NRAO	38.25	79.84
NRL	38.37	77.23

Scale in km
: kilometers x 10^2)

VLBA with FRESNOSW
plus GOLDSTONE (DSS13),
GREEN BANK,
NRL, HAYSTACK
and assuming
VLBA at QUABBIN

500 km scale

Figure 5



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PIETOWN	34.33	108.14
KITT	31.96	111.60
LASL2	35.81	106.27
OROVILE	48.90	119.75
FDVSNEW	30.47	103.95
ARECIBO	18.34	66.75
IOWA	41.58	91.57
OVRO	37.05	118.28
HAWAII	19.80	155.50
HSTK	42.43	71.49
AN9	34.24	107.63
AW9	33.97	107.81
AE9	34.00	107.41
AW3	34.06	107.64
BERNARDO	34.35	106.90
DUSTY	33.62	107.65
ROSWELL	33.40	104.55
FRESNOSW	36.50	120.50

Scale in km
(kilometers x 10^2)

500 Km

Full VLBA with FRESNO SW plus OVRO and 3 proposed additional sites for VLBA in New Mexico

Figure 6